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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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09/586,441

06/02/2000

Slobodan Nedic

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EXAMINER

BURD, KEVIN MICHAEL

ART UNIT

PAPER NUMBER

2631

DATE MAILED: 10/29/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/586,441

Applicant(s)

NEDIC, SLOBODAN

Examiner

Kevin M. Burd

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2631

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 01 July 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-50 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 21-27 and 44-50 is/are allowed.
- 6) ☒ Claim(s) 1-5, 8-13, 16-20 and 28-43 is/are rejected.
- 7) ☒ Claim(s) 6, 7, 14 and 15 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

1. This office action, in response to the remarks filed 7/1/2004, is a non-final office action.

Response to Arguments

2. The declaration under 37 CFR 1.132 filed 7/1/2004 is sufficient to overcome the rejection of claims 1-20 and 28-43 based upon US Patent No. 6,563,841.
3. Applicant's arguments with respect to claims 21-27 and 44-50 have been fully considered and are persuasive. The rejections of these claims have been withdrawn.
4. New rejections of claims 1-20 and 28-43 are stated below as well as a new claim objection to claim 35.

Claim Objections

5. Claim 35 is objected to because of the following informalities: no "said second stage" is disclosed in claim 28. The examiner believes claim 35 should be dependent on claim 21. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-3, 5, 8-10, 28-30 and 32-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al (US 6,754,261) in view of Hunt et al (US 5,400,322).

Regarding claims 1, 8-10, 28, 33-35, Lui (US 6,754,261) discloses a receiver circuit for providing a decoded output from a DMT input signal (figure 8 and column 4, lines 21-23). The input signal is digital (figure 8, 831). A first stage 833 applies a discrete Fourier transform to the input signal. The frequency samples are processed in block 834, which performs gain scaling and FEQ on a per-subchannel (per-bin) basis, slices the sample in each sub-channel to the nearest constellation point and decodes the constellation points to recover the transmitted information bits (column 8, lines 4-9).

A time domain equalizer stage is shown in 832. The primary function of the TEQ is to "shorten" the transmission channel of a DMT signal so that the combined (shortened) channel has energy confined to the cyclic prefix window (column 8, lines 14-18). This is the time domain windowing and occurs prior to the DFT. Liu does not disclose using a MLSE algorithm to recover the original transmitted data. Hunt discloses using a trellis decoder for receiving the output of a FEQ as shown in figure 2. The output of the FEQ in the unit 42 are converted by the trellis decoder 42, operating in accordance with the Viterbi algorithm to perform maximum likelihood sequences estimation (column 5, lines 21-25). It would have been obvious for one of ordinary skill in the art at the time of the invention to combine the teachings of Hunt into the receiver of Liu. The trellis decoder is well known in the art of data communications for minimizing inter-symbol interference in multi-carrier communication systems. Therefore, the originally transmitted data will be recovered faster than if more interference was present.

Regarding claims 2 and 29, the time domain equalizer (TEQ) is disclosed in figure 8.

Regarding claims 3 and 30, the windowing occurs after the TEQ (column 8, lines 13-22).

Regarding claims 5 and 32, the combination discloses the per-subchannel decoding occurs prior to the trellis decoder.

7. Claims 4 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al (US 6,754,261) in view of Hunt et al (US 5,400,322) further in view of Belotserkovsky et al (US 6,628,735).

Regarding claims 4 and 31, Lui and Hunt disclose a receiver and method for receiving signals as stated above in paragraph 6. The combination does not disclose using a Hanning window for windowing the time domain signal. Belotserkovsky discloses time domain windowing the received digital signal in figure 6. Applying the window function to the sampled data produces two benefits. First the main lobe of each pilot bin will be widened or spread and the sidelobes of the pilot bins will be lowered and cause less interference with neighboring pilot bins (column 7, lines 13-27). It would have been obvious for one of ordinary skill in the art at the time of the invention to incorporate the windowing of Belotserkovsky into the receiver of the combination of Lui and Hunt for the reasons stated above.

8. Claims 11-13, 16-20, 36-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liu et al (US 6,754,261) in view of Hunt et al (US 5,400,322) further in view of Zheng (US 5,477,465)

Regarding claims 11, 17-19, 36, 40-42, Lui (US 6,754,261) discloses a receiver circuit for providing a decoded output from a DMT input signal (figure 8 and column 4, lines 21-23). The input signal is digital (figure 8, 831). A first stage 833 applies a discrete Fourier transform to the input signal. The frequency samples are processed in block 834, which performs gain scaling and FEQ on a per-subchannel (per-bin) basis, slices the sample in each sub-channel to the nearest constellation point and decodes the constellation points to recover the transmitted information bits (column 8, lines 4-9). Liu does not disclose using a MLSE algorithm to recover the original transmitted data. Hunt discloses using a trellis decoder for receiving the output of a FEQ as shown in figure 2. The output of the FEQ in the unit 42 are converted by the trellis decoder 42, operating in accordance with the Viterbi algorithm to perform maximum likelihood sequences estimation (column 5, lines 21-25). It would have been obvious for one of ordinary skill in the art at the time of the invention to combine the teachings of Hunt into the receiver of Lui. The trellis decoder is well known in the art of data communications for minimizing inter-symbol interference in multi-carrier communication systems. Therefore, the originally transmitted data will be recovered faster than if more interference was present. The combination of Lui and Hunt does not disclose a frequency domain windowing stage disposed between the DFT and the decoding stage. Zheng discloses spectral energy information can be made even more accurate by

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reducing the leakage of one frequency to another, which is typical for DFT, by applying some windowing to the input signal (column 4, lines 30-46). Therefore, it would have been obvious for one of ordinary skill in the art at the time of the invention to combine the teachings of Zheng into the combination of Lui and Hunt. The windowing techniques are advantageous because the bands are centered around tones and these windows prevent errors for tones near the edges of the frequency bands (column 4, lines 30-46).

Regarding claims 12 and 37, Lui discloses a TEQ in figure 8 prior to the DFT.

Regarding claims 13 and 38, the combination discloses the per-subchannel decoding occurs prior to the trellis decoder.

Regarding claims 16 and 39, the windowing will occur after the DFT.

Regarding claims 20 and 43, Zheng discloses using a Hanning window (column 4, lines 30-46).

Allowable Subject Matter

9. Claims 21-27 and 44-50 are allowed.
10. Claims 6, 7, 14 and 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The references stated above do not disclose the specifics of the per-bin (subchannel) equalizing stage as stated in claims 6, 7, 14 and 15.

The following is an examiner's statement of reasons for allowance: the references stated above do not disclose the MLSE algorithm includes a calculation of state metrics and is modified to include subtraction of estimated noise samples using noise prediction coefficients in the receiver circuit and method of claims 21-27 and 44-50.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin M. Burd whose telephone number is (571) 272-3008. The examiner can normally be reached on Monday - Thursday 9 am - 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mohammad Ghayour can be reached on (571) 272-3021. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Kevin M. Burd
10/28/2004

KEVIN BURD
PATENT EXAMINER